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(54) Sheet material for forming the loop portion for hook and loop fasteners.

(57) A sheet material (10) adapted to be cut into pieces to form the loop portions for fasteners of the type comprising releasably engageable hook and loop portions. The sheet material (10) comprises a multiplicity of fibers (16) having portions bonded to a backing (12) along its front surface at spaced bonding locations (18) to form arcuate portions (20) of the fibers projecting from the front surface (13) of the backing (12). The arcuate portions (20) have a height from the backing of less than about 0.64 centimeters, and the fibers (16) have a basis weight in the range of 5 to 100 grams per square meter measured along the front surface (13) to provide sufficient open area between the fibers (16) to afford ready engagement of those fibers (16) by the hook portions of a fastener.

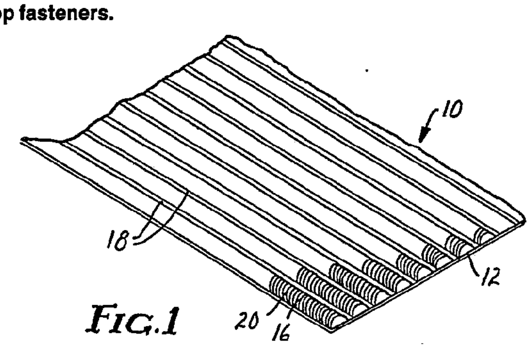

FIG.1

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Description

SHEET MATERIAL FOR FORMING THE LOOP PORTION FOR HOOK AND LOOP FASTENERS

Technical Field

The present invention relates to sheet materials adapted to be cut into pieces to form the loop portions for fasteners of the type including releasably engageable hook and loop portions, and methods for making such sheet materials.

Background of the Invention

Many sheet materials are known that are adapted to be cut into pieces to form the loop portions for fasteners of the type comprising releasably engageable hook and loop portions. Such sheet materials typically comprise a backing and a multiplicity of loops anchored in the backing and projecting a front surface of the backing so that they may be releasably engaged with the hooks on the hook portion of such a fastener, and can be made by many methods including conventional weaving, or knitting techniques. Such a sheet material in which the loops are stitched into the backing is described both in U.S. Patent No. 4,609,581, and in U. S. Patent Application No. 760,999. While the loop fastener portions made from many such loop materials work well with many different hook fastener portions, many of the processes by which they are made are more expensive than may be desired, particularly when the loop fastener portions are intended for a limited amount of use, such as to attach a disposable diaper to an infant, or to attach an abrasive disk to a backing pad by which it is driven.

Disclosure of Invention

The present invention provides a sheet material adapted to be cut into pieces to form the loop portions for fasteners of the type comprising releasably engageable hook and loop portions, which sheet material provides effective loop fastener portions for such fasteners while being very inexpensive to manufacture so that they are economical to use when the loop fastener portions are intended for a limited amount of use, such as to releasably attach a disposable diaper or other garment, or to attach an abrasive disk to a backing pad by which it is driven.

According to the present invention there is provided a sheet material adapted to be cut into pieces to form loop portions for fasteners, which sheet material comprises a backing, and a multiplicity of fibers having portions bonded to the backing along a front surface at spaced bonding locations to form arcuate portions of the fibers projecting from the front surface of the backing between the bonding locations. The arcuate portions have a height from the backing of less than about 0.64 centimeters (0.250 inch) and preferably less than about 0.318 centimeters (0.125 inch). The width of the bonding locations should be between about 0.005 and 0.075 inch, and the width of the arcuate portions of the fibers should be between about 0.06 and 0.35 inch. The fibers in the arcuate portions project to about the same height above the front surface, which height is at least one third, and preferably one half to one and one half the distance between the bonding locations, the individual fibers are less than 15 denier in size, and the fibers collectively have a basis weight in the range of 5 to 200 grams per square meter (and preferably in the range of 10 to 75 grams per square meter) measured along the front surface of the backing to provide sufficient open area between the fibers along the arcuate portions (i.e., between about 10 to 70 percent open area) to afford ready engagement of the fibers along the arcuate portions by the hook portion of the fastener.

Preferably the sheet material according to the present invention is made from the fibers and backing by forming the fibers into a sheet of fibers having arcuate portions projecting in the same direction from spaced anchor portions of the sheet of fibers, and bonding the spaced anchor portions of the sheet of fibers to the backing so that the arcuate portions project from the front surface of the backing. This forming of the fibers is preferably done by providing first and second generally cylindrical corrugating members each including a plurality of uniformly spaced ridges defining its periphery, mounting the corrugating members in axially parallel relationship with portions of the ridges of the corrugating members in mesh with each other, rotating at least one of the corrugating members, feeding the sheet of fibers between the meshed portions of the ridges of the rotating corrugating members to generally conform the sheet of fibers to the periphery of the first corrugating member, thereby forming the arcuate portions of the sheet of fibers in spaces between the ridges of the first corrugating member and the anchor portions of the sheet of fibers along outer surfaces of the ridges of the first corrugating member, and retaining the formed sheet of fibers along the periphery of the first corrugating member after it has moved past the meshing portions of the ridges. The anchor portions of the sheet of fibers are then bonded to the front surface of the backing while they are on the end surfaces of the ridges on the first corrugating member, and the thus formed sheet material is separated from the first corrugating member.

The ridges can be elongate and generally parallel so that the bonding locations are also elongate and generally parallel and are continuous in one direction across the front surface of the backing so that continuous rows of the arcuate portions extend across the backing of the sheet material; or alternately the ridges can be elongate, generally parallel, and in a regular pattern of discontinuous lengths so that the parallel bonding locations are also in a regular pattern of discontinuous lengths to to form a regular pattern of discontinuous rows of the arcuate portions along the front surface of the backing. Also it is contemplated that

the ridges of the first corrugating member can form interlocking closed patterns (e.g., circular, diamond shaped, octagonal, etc.) to form corresponding patterns for the arcuate portions of the fibers along the front surface of the backing, in which case the second corrugating member will be formed with post like ridges to press the fibers into the centers of the closed patterns.

Elongate ridges on the corrugating members can be oriented at any angle in the range of 0 to 90 degrees with respect to their axes so that the rows of arcuate portions, whether continuous or discontinuous, can be oriented along or transverse to the sheet of fibers fed between the corrugating member or at any angle therebetween.

The backing could be a woven, knitted, random woven, nonwoven or other layer of intertwined fibers, but preferably is a continuous polymeric film in the range of about 0.0025 to 0.013 centimeters (0.001 to 0.005 inch) thick which is generally less expensive than a backing of entwined fibers and allows the backing to be printed by conventional methods along one of its surfaces with graphics (such as advertising, instructions or locating marks) which will be visible through the loop portions of the fibers due to their large percentage of open area. The film may be a single layer of a polymeric material such as polypropylene, polyester, or polyamide; or may have a plurality of layers such as a central layer of a relatively high strength material such as polyester, a layer defining the first surface of a material more easily bonded to the fiber such as ethylene vinyl acetate or polyethylene, and a layer defining its second surface adapted to adhere the backing to a substrate such as polyethylene or a bonding layer of room-temperature non-tacky thermoplastic material adapted to adhere a fastener portion to a polyolefin layer (such as may be found on a disposable diaper) that can be bonded to the polyolefin layer under heat and pressure that leaves the polyolefin layer substantially undeformed and will hold the fastener portion to the polyolefin layer with greater force than that which is required to separate an engaged fastener, which bonding layer of room-temperature non-tacky thermoplastic material is described in U.S. Patent application No. 126,746 filed November 30, 1987, and can include from about 40% to about 100% of a thermoplastic material having a softening point of generally below 120 degrees Centigrade and preferably below 100 degrees Centigrade, and from about 60% to about 0% of a tackifying resin that has a softening point below about 105 degrees Centigrade and preferably below 95 degrees Centigrade. Suitable thermoplastic materials include ethylene and propylene based copolymers such as ethylene/vinyl acetate copolymers, ethylene/acrylic acid copolymers, and ethylene/methacrylic acid copolymers. Preferred thermoplastic materials include ethylene/vinyl acetate copolymers, especially those with a melt flow index from about 40 to about 2500, and preferably with a melt flow index between about 50 and about 1000. Such materials are available commercially as Elvax 40W, Elvax 150, Elvax 210W, Elvax 220W, Elvax 310, Elvax 410, and Elvax 4980W from E. I. DuPont de Nemours and Co. of Wilmington, Delaware; Escorene UL7710 and Escorene UL7720 from Exxon Chemical Co., Houston, Texas; and Ultrathene 639-35 and Ultrathene 649-04, available from USI Chemical Co. of Cincinnati, Ohio. Suitable tackifying resins are preferably solid or semisolid, however liquid tackifying resins can also be used. The tackifying resin, when used, should be compatible with the thermoplastic material and may include rosin esters, rosin acids, and derivatives of these; hydrogenated rosin esters and rosin acids and derivatives of these; aliphatic hydrocarbon resins; mixed aliphatic/aromatic hydrocarbon resins, polyterpene resins; resins made from the polymerization and hydrogenation of a dicyclopentadiene feed stream; polyterpene resins and aromatic-modified polyterpene resins; resins made from the polymerization and hydrogenation of a C9 hydrocarbon stream; and resins made from the polymerization and hydrogenation of a mixture of alphamethyl styrene, styrene, and vinyl toluene. Preferred tackifying resins include aliphatic hydrocarbon resins such as Escorez 1580 and Escorez 1310, available from Exxon Chemical of Houston, Texas; Hercotac 95, available from Hercules Chemical Co. of Wilmington, Delaware; and Wingtack Plus and Wingtack 95, available from the Goodyear Tire and Rubber Company of Akron, Ohio. Additional preferred solid tackifying resins include the aromatic-modified polyterpene resins such as Wingtack 86, available from Goodyear; Zonatac 105, available from Arizona Chemical Co. of Panama City, Florida; and Res D-2083, available from Hercules; resins made from the polymerization and hydrogenation of a dicyclopentadiene feed stream such as Escorez 5380, available from Exxon; resins made from the polymerization and hydrogenation of a C9 hydrocarbon stream such as Arkon P-90, available from Arakawa Chemical Co. USA of Chicago, Illinois; and resins made from the polymerization and hydrogenation of mixtures of alphamethyl styrene, styrene, and vinyl toluene such as Regalrez 1065, Regalrez 1078, and Regalrez 1094, available from Hercules. Conventional additives for hot-melt adhesives may also be incorporated into the bonding layer, including, but not limited to, waxes, fillers, oils, pigments, antioxidants, ultraviolet light stabilizers, and heat stabilizers.

The individual fibers may be of many polymeric materials such as polypropylene, polyethylene, polyester, or polyamide, or combinations of such materials such as a core of polyester and a sheath of polypropylene which provides relatively high strength due to its core material and is easily bonded due to its sheath material. Fibers of one material or fibers of different materials or material combinations may be used in the same sheet material.

The sheet of fibers may be fed between the meshed ridges of the corrugating members in the form of a non woven or random woven sheet or web in which the fibers may or may not be bonded together. In such a sheet the fibers may be disposed in various directions with respect to the direction the sheet of fibers is fed between the corrugating members so that in the resultant sheet material the fibers are disposed in various directions with respect to the spaced bonding locations. In such a sheet to be fed between corrugating members with spaced parallel ridges, preferably a majority of the fibers (e.g., over 90 percent) project in one direction along

the web and the web is fed between the corrugating members with that direction at about a right angles to the ridges on the corrugating members so that in the resultant sheet material a majority of the fibers project generally at about right angles to the parallel bonding locations.

Alternatively, the fibers may be provided in the form of yarns in the range of 50 to 300 denier, the yarns distributed to provide a sheet of generally uniformly distributed fibers by passing them through a comb, and the sheet of fibers fed between corrugating members having elongate parallel ridges oriented in the range of 0 to 45 degrees with respect to their axes in a direction perpendicular to their axes, which results in a sheet material in which the fibers all extend in directions at about the same angles with respect to the parallel bonding locations.

When the contacting portions of the backing and the fibers are of the same thermoplastic material, bonding of the fibers to the backing can be done by sonic welding or other means of applying heat and pressure to fuse the fibers to the backing at the bonding location. Alternatively, or when the contacting portions of the backing and the fibers are of different materials, the fibers may be adhesively bonded to the backing such as by softening a thermoplastic adhesive layer of the backing by sonic energy or other means of applying heat and pressure to adhere the fibers to the backing at the bonding locations.

Brief Description of Drawing

The present invention will be further described with reference to the accompanying drawing wherein like reference numerals refer to like parts in the several views, and wherein:

Figure 1 is a perspective view of a sheet material according to the present invention;

Figure 2 is a much enlarged top plan view of the sheet material of Figure 1;

Figure 3 is a much enlarged end view of the sheet material of Figure 1;

Figure 4 is a schematic view illustrating an apparatus and a method according to the present invention for making the sheet material of Figure 1;

Figures 5 and 6 are top and side views respectively illustrating a first alternate embodiment of the apparatus of Figure 4;

Figures 7 and 8 are top and side views respectively illustrating a second alternate embodiment of the apparatus of Figure 4; and

Figures 9 and 10 are top and side views respectively of an alternate embodiment of a sheet material according to the present invention made by the apparatus of Figures 7 and 8.

Detailed Description

Referring now to the drawing, there is shown in Figures 1, 2 and 3 a sheet material according to the present invention, generally designated by the reference numeral 10, which sheet material 10 is adapted to be cut into pieces to form the loop portions for fasteners of the type having releasably engageable hook and loop portions.

Generally the sheet material 10 comprises a transparent thermoplastic film backing 12 (e.g., of polypropylene or polyester) in the range of about 0.0025 to 0.013 centimeters (0.001 to 0.005 inch) thick having front and rear major surfaces 13 and 14, and a multiplicity of fibers 16 having portions bonded (i.e., by being fused or adhesively attached) to the front surface 13 of the backing 12 at spaced elongate generally parallel bonding locations 18 that are continuous in one direction along the front surface 13 to form arcuate portions 20 of the fibers 16 projecting from the front surface 13 of the backing 12 between the bonding locations 18 in continuous rows transversely across the sheet material 10. The arcuate portions 20 of the fibers 16 have a generally uniform height from the backing 12 of less than about 0.64 centimeters (0.250 inch) and preferably less than about 0.318 centimeters (0.125 inch), the height of the fibers 16 is at least one third, and preferably one half to one and one half times the distance between the bonding locations 18, the individual fibers 16 are less than 15 denier (preferably in the range of 1 to 10 denier) in size, and the fibers 16 without the backing 12 have a basis weight in the range of 5 to 200 grams per square meter (and preferably in the range of 10 to 75 grams per square meter) measured along the first surface 13 to provide sufficient open area between the fibers 16 along the arcuate portions 20 (i.e., between about 10 and 70 percent open area) to afford ready engagement of the fibers 16 along the arcuate portions 20 by the hook portion of the fastener.

The fibers 16 can be disposed in various directions with respect to the parallel bonding locations 18 and may or may not be bonded together at crossover points in the arcuate portions 20; can be disposed in various directions with respect to the parallel bonding locations 18 with the majority of the fibers 16 (i.e., over 90 percent) extending in directions at about a right angle to the bonding locations 18; or all of the fibers 16 can extend in directions generally at right angles to the spaced generally parallel bonding locations 18.

The backing 12 may have printing 22 along either one or both of its surfaces 13 or 14 applied by conventional printing techniques, which printing 22 is readily visible through the arcuate portions 20 of the fibers 16.

Figure 4 schematically illustrates a method according to the present invention for forming the sheet material 10 which generally comprises forming the fibers 16 into a sheet of fibers having arcuate portions projecting in the same direction from spaced generally parallel anchor portions 24 of the sheet, and bonding the spaced generally parallel anchor portions 24 of the sheet of fibers 16 to the front surface 13 of the backing 12 with the arcuate portions of the fibers 16 projecting from the front surface 13 of the backing 12. This method is preferably performed by providing first and second heated (e.g., 280 degrees F) corrugating members or rollers 26 and 27 each having an axis and including a plurality of circumferentially spaced generally axially

extending ridges 28 around and defining its periphery, with the ridges 28 having outer surfaces and defining spaces between the ridges 28 adapted to receive portions of the ridges 28 of the other corrugating member in meshing relationship with the sheet of fibers between the meshed ridges 28 and to afford rolling engagement between the ridges 28 and spaces of the corrugating members in the manner of gear teeth. The corrugating members 26 and 27 are mounted in axially parallel relationship with portions of the ridges 28 of the corrugating members 26 and 27 meshing generally in the manner of gear teeth; at least one of the corrugating members 26 or 27 is rotated; and the sheet of fibers is fed between the meshed portions of the ridges 28 of the corrugating members 26 and 27 to generally conform the sheet of fibers to the periphery of the first corrugating member 26 and form the arcuate portions of the fibers 16 in the spaces between the ridges 28 of the first corrugating member 26 and the generally parallel anchor portions 24 of the sheet of fibers along the outer surfaces of the ridges 28 on the first corrugating member 26. The formed sheet of fibers is retained along the periphery of the first corrugating member 26 after it has moved past the meshed portions of the ridges 28; the backing 12 is bonded to the parallel anchor portions 24 of the sheet of fibers on the end surfaces of the ridges 28 on the first corrugating member 26 as by the action of a sonic welder 30 or by other sources of heat and pressure such as heat from within the first corrugating member 26; and the bonded backing 12 and fibers 16 or sheet material 10 is separated from the first corrugating member 26.

The sheet of fibers fed between the meshed portions of the ridges 28 of the corrugating members 26 and 27 can be in the form of a non woven web or sheet, or, as illustrated in Figure 4, in the form of yarns 33 distributed to provide a sheet of uniformly distributed fibers by passing the yarns 33 through a comb 34 and fed between the meshed portion of the ridges 28 of the corrugating members 26 and 27 with all of the fibers 16 extending generally perpendicular to the axes of the corrugating members 26 and 27. Corrugating members 26 and 27 adapted to have such a sheet of fibers 32 fed into them can have their ridges 28 oriented generally in the range of 0 to 45 degrees with respect to their axes, but preferably have their ridges 28 oriented at about 5 degrees with respect to their axes so that the sonic welder 30 will always be adjacent and heating the parallel portions 24 of the sheet of fibers along a portion of at least one of the ridges 28 to help even out the energy output of the sonic welder 30 and so that the fibers 16 in the sheet material 10 all extend in directions at about right angles (i.e., 85 degrees) to the parallel bonding locations 18.

Additionally, the method can further include printing the backing along one of its surfaces prior to the bonding step, as along its rear surface 14 with a printer 36, which may preferably be done at a location remote from the corrugating members 26 and 27.

Figures 5 and 6 schematically illustrate a first alternate way to perform the method according to the present invention for forming a sheet material 40 according to the present invention, which method generally comprises forming fibers 38 into a sheet having arcuate portions 41 projecting in the same direction from spaced generally parallel anchor portions of the sheet, and bonding the spaced anchor portions of the sheet of fibers with the fibers along a front surface of a backing 43 with the arcuate portions 41 projecting from the front surface of the backing 43. As illustrated, the method can be performed by providing first and second cylindrical heated corrugating members or rollers 44 and 45 each having an axis and including a plurality of generally annular, circumferentially extending, axially spaced ridges 46 around and defining its periphery, with the ridges 46 having outer surfaces and defining spaces between the ridges 46 adapted to receive portions of the ridges 46 of the other corrugating member 44 or 45 in meshing relationship with the sheet of fibers between the meshed portions of the ridges 46. The corrugating members 44 and 45 are mounted in axially parallel relationship to mesh portions of the ridges 46 of the corrugating members 44 and 45; at least one of the corrugating members 44 or 45 is rotated; and the sheet of fibers is fed between the meshed portions of the ridges 46 of the corrugating members 44 and 45 to generally conform the sheet of fibers to the periphery of the first corrugating member 44 and form the arcuate portions 41 of the fibers in the spaces between the ridges 46 of the first corrugating member 44 and the generally parallel anchor portions of the fibers along the outer surfaces of the ridges 46. The formed sheet of fibers is retained along the periphery of the first corrugating member 44 after separation of the ridges 46; the backing 43 is bonded to the parallel anchor portions 42 of the sheet of fibers on the end surfaces of the ridges 46 of the first corrugating member 44 at spaced elongate generally parallel bonding locations corresponding to the end surfaces of the ridges 46 on the first corrugating member 44 as by the action of a sonic welder 50 or by other sources of heat and pressure such as heat from within the first corrugating member 44; and the thus completed sheet material 40 is separated from the first corrugating member 44.

The fibers 38 fed between the meshed ridges 46 of the corrugating members 44 and 45 can be in the form of a non woven web formed by adhering the fibers together, or another sheet formed of the fibers that has sufficient internal strength so that the sheet of fibers will corrugate longitudinally to conform to the ridges 46 as it is pulled into the nip between the meshing ridges 46 of the corrugating members 44 and 45. Preferably a majority of the fibers 38 in such a non woven sheet of fibers are oriented transversely of the direction the sheet of fibers is fed between the corrugating members 44 and 45 so that a majority of the fibers in the resultant sheet material 40 extend in directions at about right angles to the parallel bonding locations. Additionally, the method can further include printing the backing along one of its surfaces prior to the bonding step (not shown).

Like the sheet material 10, the sheet material 40 made by the method illustrated in Figures 5 and 6 comprises the backing 43 (which can be a thermoplastic film), and the fibers 38 which are bonded (i.e., by being fused or adhesively attached) to the backing 43 at the spaced elongate generally parallel bonding locations along the

front surface, which bonding locations are continuous in one direction across the sheet material 40 to form arcuate portions 54 of the fibers 38 projecting from the front surface of the backing 43 between the bonding locations in continuous rows, except that the continuous rows of arcuate portions 54 in the sheet material 40 extend longitudinally along the sheet material 40 instead of transversely across the sheet material as in the case of the sheet material 10.

Figure 7 and 8 schematically illustrate a second alternate way to perform the method according to the present invention for forming a sheet material 60 illustrated in Figures 9 and 10, which method illustrated in Figures 7 and 8 generally comprises forming fibers 59 into a sheet having arcuate portions 61 projecting in the same direction from spaced generally parallel anchor portions 62 of the sheet of fibers, and bonding the spaced generally parallel anchor portions 62 of the sheet of fibers to a front surface 58 of a backing 63 to form bonding locations 68 with the arcuate portions 61 projecting from the front surface 58. As illustrated, the method can be performed by providing first and second cylindrical heated corrugating members or rollers 64 and 65 each having an axis and including a plurality of circumferentially spaced generally axially extending discontinuous ridges 66 around and defining its periphery, with the ridges 66 on each corrugating member 64 or 65 having outer surfaces and defining spaces between the ridges 66 adapted to receive a portion of the ridges 66 of the other corrugating member 64 or 65 in meshing relationship in the manner of a pair of gears with the sheet of fibers 59 between the meshed portions of the ridges 66. The corrugating members 64 and 65 are mounted in axially parallel relationship to mesh portions of the ridges 66 of the corrugating members 64 and 65 in the manner of gear teeth; at least one of the corrugating members 64 or 65 is rotated; and the sheet of fibers 59 is fed between the meshed portions of the ridges 66 of the corrugating members 64 and 65 to generally conform the sheet of fibers to the periphery of the first corrugating member 64 and form the arcuate portions 61 of the fibers in the spaces between the ridges 66 of the first corrugating member 64 and the generally parallel anchor portions 62 of the sheet of fibers along the outer surfaces of the ridges 66. The formed sheet of fibers is retained along the periphery of the first corrugating member 64 after it moves past the meshing portions of the ridges 66; the backing 63 is bonded to the parallel anchor portions 62 of the sheet of fibers on the end surfaces of ridges 66 of the first corrugating member 64 as by the action of a sonic welder 67 or by other sources of heat and pressure such as heat from within the first corrugating member 64; and the thus completed sheet material 60 is separated from the first corrugating member 64.

The fibers 59 can be fed between the meshed portions of the ridges 66 of the corrugating members 64 and 65 in the form of yarns 70 distributed to provide a sheet of uniformly distributed fibers 59 by passing the yarns 70 through a comb 72 and fed between the meshed ridges 66 of the corrugating members 64 and 65 with all of the fibers extending generally perpendicular to the axes of the corrugating members 64 and 65, in which case the corrugating members 64 and 65 can have their ridges 66 oriented in the range of 0 to 45 degrees with respect to their axes, but preferably have their ridges 66 oriented at about 5 degrees with respect to their axes so that the sonic welder 67 will always be adjacent and heating the parallel anchor portions 62 of fibers along a portion of one of the ridges 66 to help even out the energy output of the welder 67 and so that in the sheet material 60 the fibers all extend in directions at about right angles (i.e., 85 degrees) to parallel bonding locations 68 between the fibers 59 and the backing 63. Alternatively, the fibers 59 fed between the meshed ridges 66 of the corrugating members 64 and 65 can be in the form of a non woven or random woven web formed by adhering fibers together or laying unattached fibers together. In that case the ridges 66 may be oriented at any angle with respect to the axes of the corrugating members 64 and 65, and preferably a majority of the fibers in such a sheet of fibers are oriented at right angles to the ridges 66 so that a majority of the fibers in the resultant sheet material 60 extend in directions at about right angles to the parallel bonding locations 68. Additionally, the method can further include printing the backing along one of its surfaces prior to the bonding step (not shown). Additionally, the method can further include printing the backing along one of its surfaces prior to the bonding step (not shown).

Like the sheet materials 10 and 40, the sheet material 60 made by the method illustrated in Figures 7 and 8 and illustrated in Figures 9 and 10 Comprise the backing 63 (which can be a thermoplastic film), and the fibers 59 which are bonded (i.e., by being fused or adhesively attached) to the front surface 58 of the backing 63 at the spaced elongate generally parallel bonding locations 68 to form rows of the arcuate portions 61 of the fibers 59 projecting from the front surface 58 of the backing 63 between the bonding locations 68, except that the rows of arcuate portions 69 are discontinuous and form a regular pattern along the sheet material 60 instead of being continuous in one direction across the sheet material as in the case of the sheet materials 10 and 40.

The following are illustrative examples of sheet materials according to the present invention formed by the method described above.

Example 1

A sheet material according to the present invention was made using 2.4 denier individual polypropylene fibers commercially available as style 80/2 yarn, 70/34 denier Solution-dyed Stuffer Crimped Olefin Fibers from Roselon Industries of New York, N.Y., and a backing of conventional polypropylene film (some of which was printed on one surface) with a thickness of about 50 microns. The yarns of polypropylene filaments were passed through a comb having 6.3 teeth per centimeter (16 teeth per inch) to form a sheet of uniformly distributed filaments that was then fed between two corrugating rollers with meshing ridges of the type described above with reference to Figure 4, carried along the periphery of a first one of the corrugating rollers,

and had the parallel anchor portions of the sheet of fibers carried along the outer surfaces of the ridges ultrasonically fused to the backing in the manner described above. The ridges and spaces between the ridges were shaped to cause a feed rate of the sheet of fibers about twice that of the film backing and to result in sheet material having parallel elongate bonding locations generally perpendicular to all of the fibers, having a transverse width of about 0.076 centimeter and spaced every 0.381 centimeter along the sheet material; and having projecting arcuate portions of the fibers roughly semicircular in shape with heights of about 0.381 centimeter (0.15 inch) between the parallel bonding locations. The printing on the backing could be easily seen through the arcuate portions of the fibers. The sheet material was tested for Dynamic Shear and T-Peel in accordance with the test methods described at the end of this specification when engaged with a 2 inch by 1 inch sized piece of both the mushroom headed hook material sold under the trade designation SJ-3492, "SCOTCHMATE" Fastener, by Minnesota Mining and Manufacturing Co., St. Paul, Minn., and a hook material (called "Extruded Hook Material" herein) made in accordance with the teaching in U.S. Patent Application No. 142,551, filed January 11, 1988, by extruding a thermoplastic resin through a die shaped to form a base layer and spaced ridges projecting above an upper surface of the base layer that have the cross sectional shape of the hook portions to be formed, transversely cutting the ridges at spaced locations along their length to form discrete portions of the ridges, and stretching the backing layer to separate those portions of the ridges which are then the spaced hook members, which hook members each comprise a stem portion attached at one end to the backing, and a head portion at the end of the stem portion opposite the backing, the hook members each have a height dimension from the upper surface of the backing of 0.102 centimeter (0.04 inch); the stem and head portions each have generally the same thickness dimension of about 0.025 centimeter (0.01 inch) in a first direction parallel to the surfaces of the backing; the stem portions each have a width dimension of about 0.027 centimeter (0.01 inch) in a second direction generally at a right angle to the first direction and parallel to the surfaces of the backing, and the head portions each have a width dimension in the second direction that is about 0.066 centimeter (0.026 inch) greater than the width dimension of the stem portion and a total width of about 0.066 centimeter (0.026 inch); the fastener portion includes about 70 hook members per square centimeter (450 hook members per square inch); while the total cross sectional area occupied by the head portions in a plane parallel to the upper surface is about 11.7 percent of the area of the upper surface.

The average results obtained are tabulated in table 1 below.

Example 2

A sheet material according to the present invention was made as described in Example 1 except that the individual fibers used were 6.2 denier polypropylene fibers commercially available in the form of 420/68 yarn from Phillips Fibers Incorporated, Greenville, SC. The printing on the backing of the sheet material could be easily seen through the arcuate portions of the fibers. The sheet material was tested as in Example 1, and the average results obtained are tabulated in table 1 below.

Example 3

A sheet material according to the present invention was made as described in Example 1 except that the individual fibers used were 6.2 denier polypropylene fibers commercially available as 420/68 yarn from Phillips Fibers Incorporated, Greenville, SC., and the ridges and spaces between the ridges of the corrugating rollers were shaped to cause projecting arcuate portions of the fibers roughly semicircular in shape with heights of about 0.318 centimeter (0.125 inch) between the parallel bonding locations. It was noted that the printing on the backing could be easily seen through the arcuate portions of the fibers. The sheet material was tested as in Example 1, and the average results obtained are tabulated in table 1 below.

Example 4

A sheet material according to the present invention was made as described in Example 1 except that no comb was used and the individual fibers used were 11 denier polypropylene sheath and polyester core fibers commercially available from BASF Corporation, Williamsburg VA, a nonwoven web having a basis weight of approximately 35 grams per square meter was formed from the fibers after orienting the majority or about 90 percent of the fibers in one direction by standard carding techniques and the nonwoven web was fed into the rollers with said one direction perpendicular to the axes of the rollers, and the ridges and spaces between the ridges of the corrugating rollers were shaped to cause projecting arcuate portions of the fibers roughly semicircular in shape with heights of about 0.318 centimeter (0.125 inch) between the parallel bonding locations. The sheet material was tested as in Example 1, and the average results obtained are tabulated in table 1 below.

TABLE 1

Example	Extruded Hook Material Dynamic Shear (pounds)	Extruded Hook Material T-Peel (pounds)	Scothmate Hooks Dynamic Shear (pounds)	Scothmate Hooks T-Peel (pounds)
1	15.0 *	1.5	9.8	0.6
2	10.9 *	0.9	9.9	0.4
3	10.9 *	0.8	7.5	0.3
4	9.8 *	1.5	6.2	0.6

* backings elongated and hooks did not release from loops

Comparative Examples 5-19

A series of sheet materials according to the present invention, Examples 5-13, were made as described in Example 4 except that the individual fibers used were a mixture of 65 percent of the 11 denier polypropylene sheath and polyester core fibers commercially available from BASF Corporation, Williamsburg VA, and 35 percent 6 denier polypropylene fibers commercially available from Hercules Inc., Wilmington, Del. The nonwoven webs made from those fibers were varied in their densities to produce a series of basis weights for the fibers (not including the backing) measured along the first surfaces of the backing of the sheet material. Also, sheet materials according to the present invention, Examples 14-19, were made as described in Example 1 except that the individual fibers used were 2.9 denier polypropylene fibers commercially available in the form of 100/34 yarn from Amoco Fabrics and Fibers Company, Atlanta, GA, the backing of the sheet material was not printed, and the fiber contents of the sheet materials were varied in their densities or basis weights by varrying the nuber of yarns per width to produce a series of basis weights for the fibers (not including the backing) measured along the first surfaces of the backing of the sheet material.

All of the sheet materials thus made were tested for T-Peel in accordance with the test method attached at the end of this specification when engaged with a 2 inch by 1 inch sized piece of both the mushroom headed hook material sold under the trade designation SJ-3492, "SCOTCHMATE" Fastener, by Minnesota Mining and Manufacturing Co., St. Paul, Minn., and the average results obtained are tabulated in table 2 below. Additionally, the arcuate portions of the fibers on certain of the sheet materials were measured on an IBAS image analyzer using routine #455, with 6 fields 2.2 square centimeters in size being measured for each sheet material, and the average results for percent open area obtained are tabulated in table 2 below.

TABLE 2

Example	Fiber Source (see above)	Fiber Basis Wt. (gms/sq.meter)	T-Peel (pounds)	Open Area (%)
5	Non Woven Mixture	20	64	
6	Non Woven Mixture	35	176	48.5
7	Non Woven Mixture	50	336	
8	Non Woven Mixture	63	314	41.9
9	Non Woven Mixture	77	516	
10	Non Woven Mixture	78	324	
11	Non Woven Mixture	80	240	
12	Non Woven Mixture	85	210	
13	Non Woven Mixture	139	118	9.3
14	Yarn	6.5	80	
15	Yarn	12	168	
16	Yarn	25	160	
17	Yarn	50	282	
18	Yarn	120	284	
19	Yarn	140	82	

Example 20

A sheet material according to the present invention was made to demonstrate adhesively bonding fibers to a backing. The sheet material was made as described in Example 1 except that no comb was used; the fibers used were 9 denier polypropylene staple fibers commercially available from Hercules Incorporated, Norcross, GA; the backing used was 0.0056 centimeter (0.0022 inch) polypropylene film extrusion coated with about 0.005 centimeter (0.002 inch) of low melt temperature tackified ethylene vinyl acetate hot melt adhesive; a

nonwoven web having a basis weight of approximately 17 grams per square meter was formed from the fibers by heat fusing them together after orienting the majority or about 90 percent of the fibers in one direction and the nonwoven web was fed into the corrugating rollers with said one direction perpendicular to the axes of the corrugating rollers; the backing was adhesively bonded to the parallel portions of the fibers carried along the outer surfaces of the ridges by heating the first roller to soften the ethylene vinyl acetate coating rather than by sonic welding; and the ridges and spaces between the ridges on the corrugating rollers were shaped to cause projecting arcuate portions of the fibers roughly semicircular in shape with radii of about 0.318 centimeter (0.125 inch) between the parallel bonding locations. The sheet material was not tested, although it appeared to work as well as the better examples described above.

Example 21

A sheet material according to the present invention was made generally as described in Example 1 except that the fibers used were those commercially available from Hercules as 10d T-181 fibers. A very open non woven web having a basis weight in the range of about 20 to 25 grams per square meter was formed from the fibers by randomly orienting the fibers and point bonding about 4 to 6% of the fibers together at their cross over points, and that web was then fed between the two corrugating rollers with meshing ridges of the type described above with reference to Figure 4, carried along the periphery of a first one of the corrugating rollers, and had the parallel anchor portions of the web or sheet of fibers carried along the outer surfaces of the ridges ultrasonically fused to the backing in the manner described above.

Example 22

A sheet material according to the present invention was made generally as described in Example 1 except that the backing of the sheet material was a bilayered film including a layer of low melt tackified ethyl vinyl acetate with a softening point of 150 degrees Fahrenheit and a layer of polypropylene similar to the film of example one; and that a rubber roll was used in place of the sonic horns to achieve adhesive bonding of the fibers to the layer of ethyl vinyl acetate through the application of heat and pressure.

Example 23

A sheet material according to the present invention was made generally as described in Example 1 except that no comb was used and the multiplicity of fibers used to form the sheet of fibers were those commercially available from Hercules as 9d T-101 fibers. The fibers were used in an amount to provide a basis weight of 45 grams per square meter for the sheet of fibers, and the orientation of the fibers in the sheet was estimated to be in a ratio of about seven in the longitudinal direction to one in the cross direction.

PEEL TEST

EQUIPMENT:

1. Tensile Tester Instron Model TM equipped with "CT" load cell or tensile tester (Thwing Albert) Model "Intelect".
2. 11 ± 1/4 lb. (5.0 ± 0.1 kg) roller with a 4 1/8" (104.8 mm) diameter and a 3" (76 mm) length capable of being rolled by hand or mechanically.
3. Hook and loop material in the width supplied, not to exceed 2" (51 mm) width; materials greater than 2" (51 mm) in width should be slit to a 2" (51 mm) width.
4. Scissors

SAMPLE:

A strip of the appropriate hook or mushroom material at least 7" (178 mm) long by width and an equal length of the loop to which it will be mated. If the samples are removed from a roll of material remove the outer lap of material before selecting the required number of strips. On each strip the end closest to the center of the roll must be marked. These markings are used to mark the directionality of the specimens.

INSTRUMENT PREPARATION:

1. See TM App. #3 for load cell calibration procedure using "CT" load cell.
2. See Instron for the following conditions:
   a. Crosshead speed: 12 in./min. (305 mm/min.)
   b. Chart speed: 5-12 in./min. (127-305 mm/min.)
   c. Gauge length: 3 ± 1/8" (76.2 ± 3.2 mm)
   d. Load range: 10 lbs. (44.5 N) full scale load
   e. Peel distance: 3" (76.2 mm)

CONDITIONS:

All hook and loop samples should be laid functional side up and conditioned for at least 24 hours at 70 ± 2°F (21.1 ± 1.1°C) and 65 ± 2% relative humidity prior to testing specimens.

PROCEDURE:

1. Carefully align and superimpose the hook strip over the loop strip so that the hook strip covers the loop strip, and the marked ends are matched. Join the strips together lightly using finger pressure.

2. Using the roller, engage the entire length of the mated strips by rolling over surface at a rate of approximately 12" (305 mm)/min. making one pass in each direction 3 times. Then hand separate at least 2-1/2" (63.5 mm) but no more than 3" (76.2 mm) of the combined specimens.

3. Place the free ends of the specimen to be tested in the Instron with the hook strip end in the upper clamp and the free end of the loop strip in the lower clamp. The peel line should be centered.

4. Turn on the pen and chart and start the peel test.

5. Ignore the first peak and from the remaining peaks, select the five highest peaks and calculate an average for the peel force value.

6. A total of 6 separate specimen combinations will be tested, 3 with marked ends together and 3 with marked ends opposite.

3 each:

```
hook  ____________________X
loop  ____________________X

hook  ____________________X
loop  X____________________
```

7. The average value of the 6 peel tests should be recorded in pounds per inch width to the nearest tenth of a pound. This value characterizes one sample.

SHEAR STRENGTH TEST

EQUIPMENT:

1. Tensile Tester Instron Model TM equipped with "CT" load cell or tensile tester, (Thwing Albert) Model "Intelect".

2. 11 ± 1/4 lb. (5.0 ± 0.1 kg) roller with a 4-1/8" (105 mm) diameter and a 3" (76 mm) length capable of being rolled by hand or mechanically.

3. Hook and loop material in the width supplied, not to exceed 2" (51 mm) width. Materials greater greater than 2" (51 mm) in width should be slit to a 2" (51 mm) width.

4. Scissors.

5. Bell jar with a super saturated solution of magnesium acetate and water in bottom to keep R.H. at 65% at 70°F (21°C).

SAMPLE:

A strip of the appropriate hook or mushroom material at least 4" (102 mm) long by width and an equal length of the loop to which it will be mated. If the samples are removed from a roll of material remove the outer lap of material before selecting the required number of strips.

INSTRUMENT PREPARATION:

1. Calibrate the load cell.

2. Set the Instron for the following conditions:

   a. Crosshead speed: 12" (305 mm)/min.
   b. Chart speed: 5-12" (127-305 mm)/min.
   c. Guage length: 3 ± 1/8" (76 ± 3 mm)
   d. Load range: 100 lbs. (445 N) full scale load

CONDITIONING:

All hook and loop samples should be laid functional side up and conditioned for at least 24 hours at 70 ± 2°F (21 ± 1°C) and 65 ± 2% relative humidity prior to testing.

PROCEDURE:

1. Place the 4" (102 mm) long strip of loop material, loop side up, on a flat rigid surface. Fasten end of the loop to the surface with pressure sensitive tape to prevent movement.
2. Carefully align and superimpose 2 ± 1/16" (50 ± 2 mm) of the hook strip over the loop strip. Join the strips together lightly using finger pressure.
3. Using the roller, engage the mated strips by rolling over the surface at a rate of approximately 12" per minute (305 mm/min.) making one pass in each direction 3 times.
4. Place the free ends of the specimen to be tested in the instron with the hook strip end in the upper clamp and the free end of the loop strip in the lower clamp. The shear line should be centered.
5. Turn on the pen and chart. Then start the shear test.
6. Observe and record the maximum value obtained during the complete separation of each of the specimen combinations.
7. A total of 4 separate specimens will be tested and the average calculated to characterize one sample.

Claims

1. A sheet material (10, 40, 60) adapted to be cut into pieces to form the loop portions for fasteners of the type comprising releasably engageable hook and loop portions, said sheet material (10, 40, 60) comprising:
a backing (12, 43, 63) having front and rear major surfaces (13 and 14, 58); and
a multiplicity of fibers (16, 38, 59) having portions bonded to said backing (12, 43, 63) along said front surface (13, 58) at spaced bonding locations (18, 68) to form arcuate portions (20, 54, 69) of said fibers (16, 38, 59) projecting from the front surface (13, 58) of said backing (12, 43, 63) between said bonding locations (18, 68), said arcuate portions (20, 54, 69) having a height from said backing (12, 43, 63) of less than about 0.64 centimeters, and said fibers (16, 38, 59) having a basis weight in the range of 5 to 200 grams per square meter measured along said first surface (13, 58) to provide sufficient open area between said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) to afford ready engagement of said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) by the hook portion of a said fastener.
2. A sheet material (10, 40, 60) according to claim 1 wherein the fibers (16, 38, 59) in said arcuate portions (20, 54, 69) project to about the same height above said front surface (13, 58), and said height is at least one third the distance between said bonding locations (18, 68).
3. A sheet material (10, 40) according to claim 1 wherein said bonding locations (18) are elongate, generally parallel, and continuous in one direction along said front surface (13) of said backing (12, 43) to form continuous rows of said arcuate portions (20, 54) along said front surface (13) of said backing (12, 43).
4. A sheet material (60) according to claim 1 wherein said bonding locations (68) are elongate, generally parallel, and in a regular pattern of discontinuous lengths to to form a pattern of discontinuous rows of said arcuate portions (69) along said front surface (58) of said backing (63).
5. A sheet material (10, 40, 60) according to claim 1 wherein said bonding locations (18, 68) are elongate and generally parallel, and said fibers (16, 38, 59) are disposed in various directions with respect to said parallel bonding locations (18, 68).
6. A sheet material (10, 40, 60) according to claim 1 wherein said bonding locations (18, 68) are elongate and generally parallel, and said fibers (16, 38, 59) are disposed in various directions with respect to said parallel bonding locations (18, 68) with the majority of said fibers (16, 38, 59) extending in directions generally at right angles to said bonding locations (18, 68).
7. A sheet material (10, 40, 60) according to claim 1 wherein said bonding locations (18, 68) are elongate and generally parallel, and essentially all of said fibers (16, 38, 59) extend in directions generally at right angles to said spaced generally parallel bonding locations (18, 68).
8. A sheet material (10, 40, 60) according to claim 1 wherein said fibers (16, 38, 59) have a basis weight in the range of 10 to 75 grams per square meter measured along said front surface (13, 58) of said backing (12, 43, 63), the fibers (16, 38, 59) in said arcuate portions (20, 54, 69) project to about the same height above said front surface (13, 58), and said height is in the range of one half to one and one half the distance between said bonding locations (18, 68).
9. A sheet material (10, 40, 60) according to claim 1 wherein said backing (12, 43, 63) is a polymeric film material less than 0.013 centimeters thick.
10. A sheet material (10, 40, 60) according to claim 1 wherein said backing (12, 43, 63) is a polymeric film material and has printing along one of said surfaces, said printing being visible through said arcuate portions (20, 54, 69) of said fibers (16, 38, 59).
11. A sheet material (10, 40, 60) according to claim 1 wherein said backing (12, 43, 63) and said fibers (16,

38, 59) comprise the same thermoplastic material, and said fibers (16, 38, 59) are fused to said backing (12, 43, 63) at said bonding locations (18, 68).

12. A sheet material (10, 40, 60) according to claim 1 wherein said backing (12, 43, 63) and said fibers (16, 38, 59) are adhesively bonded to said backing (12, 43, 63) at said bonding locations (18, 68).

13. A method for forming a sheet material (10, 40, 60) adapted to be cut into pieces to form loop portions for fasteners of the type having releasably engageable hook and loop portions, said method comprising:
providing fibers (16, 38, 59) and a backing (12, 43, 63) having front and rear major surfaces (13 and 14, 58);
forming the fibers (16, 38, 59) into a sheet having arcuate portions (20, 54, 69) projecting in the same direction from spaced anchor portions of the sheet of fibers (16, 38, 59), the arcuate portions (20, 54, 69) having a height from the anchor portions of less than 0.64 centimeters; and
bonding the spaced anchor portions of the sheet of fibers (16, 38, 59) to the front surface of the backing (12, 43, 63) with the arcuate portions (20, 54, 69) of the fibers (16, 38, 59) projecting from the front surface (13, 58) of the backing (12, 43, 63);
the sheet formed by the fibers (16, 38, 59) having a basis weight in the range of 5 to 200 grams per square meter measured along the front surface (13, 58) of the backing (12, 43, 63) to provide sufficient open area between the fibers (16, 38, 59) to afford ready engagement of the hook portion of a said fastener with the fibers (16, 38, 59) in the sheet material (10, 40, 60).

14. A method for forming a sheet material (10, 40, 60) according to claim 13 wherein said forming step comprises the steps of:
providing first and second generally cylindrical corrugating members (27, 28; 44, 45; 64, 65) each having an axis and including a plurality of spaced ridges (28, 46, 66) defining the periphery of the corrugating member, the ridges (28, 46, 66) having outer surfaces and defining spaces between said ridges (28, 46, 66) adapted to receive portions of the ridges (28, 46, 66) of the other corrugating member in meshing relationship with the sheet of fibers (16, 38, 59) therebetween;
mounting the corrugating members (27, 28; 44, 45; 64, 65) in axially parallel relationship with portions of the ridges (28, 46, 66) in meshing relationship;
rotating at least one of the corrugating members (27, 28; 44, 45; 64, 65);
feeding the sheet of fibers (16, 38, 59) between the meshed portions of the ridges (28, 46, 66) to generally conform the sheet of fibers (16, 38, 59) to the periphery of the first corrugating member (27, 44, 64) and form the arcuate portions (20, 54, 69) of the fibers (16, 38, 59) in the spaces between the ridges (28, 46, 66) of the first corrugating member (27, 44, 64) and the anchor portions of the sheet of fibers (16, 38, 59) along the outer surfaces of the ridges (28, 46, 66) of the first corrugating member; and
retaining the formed sheet of fibers (16, 38, 59) along the periphery of the first corrugating member (27, 44, 64) after movement past the meshing portions of the ridges (28, 46, 66) ;
wherein said bonding step occurs with the formed sheet of fibers (16, 38, 59) along the periphery of the first corrugating member (27, 44, 64) after movement past the meshing portions of the ridges (28, 46, 66); and
said method further includes separating the sheet material (10, 40, 60) from the first corrugating member (27, 44, 64).

15. A method according to claim 14 wherein in said feeding step the sheet of fibers (16, 38, 59) fed between the meshed portions of the ridges (28, 46, 66) of the corrugating members (27, 28; 44, 45; 64, 65) is in the form of a non woven web.

16. A method according to claim 14 wherein said ridges (28, 46, 66) are elongate and parallel, and in said feeding step the sheet of fibers (16, 38, 59) fed between the meshed portions of the ridges (28, 46, 66) of the corrugating members (27, 28; 44, 45; 64, 65) is in the form of a non woven web having a plurality of the fibers (16, 38, 59) projecting generally at a right angle to the ridges (28, 46, 66).

17. A method according to claim 14 wherein said ridges (28, 66) are elongate and parallel and are oriented at an angle in the range of 0 to 45 degrees with respect to the axes of the corrugating members (27, 28; 64, 65), and said feeding step includes the steps of:
providing the fibers (16, 59) in the form of yarns in the range of 50 to 300 denier;
distributing the yarns to provide a sheet of generally uniformly distributed fibers (16, 59); and
feeding the sheet of fibers (16, 59) between the meshed ridges (28, 66) of the gear with all of the fibers (16, 59) extending generally at a right angle to the axes of the corrugating members (27, 28; 64, 65).

18. A method according to claim 14 wherein said ridges (28, 66) are oriented at an angle of about 5 degrees with respect to the axes of the corrugating members (27, 28; 64, 65), and said feeding step includes the steps of;
providing the fibers (16, 59) in the form of yarns in the range of 50 to 300 denier;
distributing the yarns to provide a sheet of generally uniformly distributed fibers (16, 59); and
feeding the sheet of fibers (16, 59) between the meshed portions of the ridges (28, 66) with all of the fibers (16, 59) extending generally at a right angle to the axes of the corrugating members (27, 28; 64, 65).

19. A method according to claim 13 further including the step of printing the backing (12, 43, 63) along one of its surfaces prior to said bonding step.

20. A method according to claim 13 wherein the backing (12, 43, 63) and the fibers (16, 38, 59) comprise the same thermoplastic material, and said bonding step comprises fusing the fibers (16, 38, 59) to the backing (12, 43, 63) at the bonding locations (18, 68).

21. A method according to claim 13 wherein said bonding step comprises adhesively bonding the fibers (16, 38, 59) to the backing (12, 43, 63) at the bonding locations (18, 68).

22. A disposable garment including a fastener comprising releasably engageable hook and loop portions, said loop portion comprising:
a backing (12, 43, 63) having front and rear major surfaces (13 and 14, 58); and
a multiplicity of fibers (16, 38, 59) having portions bonded to said backing (12, 43, 63) along said front surface (13, 58) at spaced bonding locations (18, 68) to form arcuate portions (20, 54, 69) of said fibers (16, 38, 59) projecting from the front surface (13, 58) of said backing (12, 43, 63) between said bonding locations (18, 68), said arcuate portions (20, 54, 69) having a height from said backing (12, 43, 63) of less than about 0.64 centimeters (0.250 inch), and said fibers (16, 38, 59) having a basis weight in the range of 5 to 200 grams per square meter measured along said first surface (13, 58) to provide sufficient open area between said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) to afford ready engagement of said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) by the hook portion of said fastener.

23. A disposable garment according to claim 22 wherein said garment further includes an outer polymeric layer and said rear surface (14) of said backing (12, 43, 63) is adhered to said outer polymeric layer.

24. A disposable garment according to claim 22 in wherein said disposable garment further includes an outer polymeric layer with a portion of said outer polymeric layer providing said backing (12, 43, 63) for said loop portion.

25. An abrasive disk comprising a layer having first and second surfaces, an abrasive material adhered along said first surface, and a loop portion for a hook and loop fastener attached along said second surface, said loop portion comprising:
a backing (12, 43, 63) having front and rear major surfaces (13 and 14, 58) with said rear surface attached along the second surface of said layer; and
a multiplicity of fibers (16, 38, 59) having portions bonded to said backing (12, 43, 63) along said front surface (13, 58) at spaced bonding locations (18, 68) to form arcuate portions (20, 54, 69) of said fibers (16, 38, 59) projecting from the front surface (13, 58) of said backing (12, 43, 63) between said bonding locations (18, 68), said arcuate portions (20, 54, 69) having a height from said backing (12, 43, 63) of less than about 0.64 centimeters (0.250 inch), and said fibers (16, 38, 59) having a basis weight in the range of 5 to 200 grams per square meter measured along said front surface (13, 58) to provide sufficient open area between said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) to afford ready engagement of said fibers (16, 38, 59) along said arcuate portions (20, 54, 69) by the hook portion of said fastener.

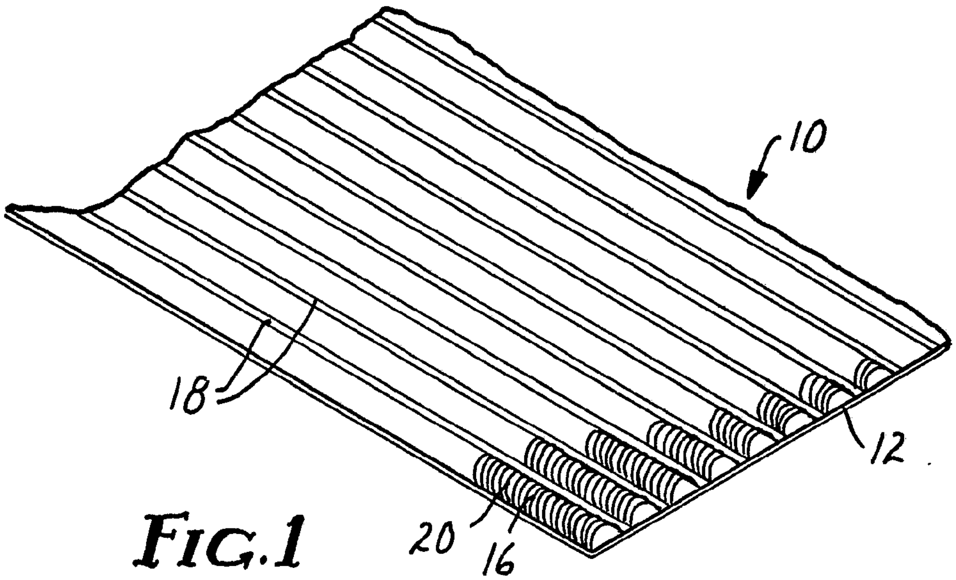

FIG.1

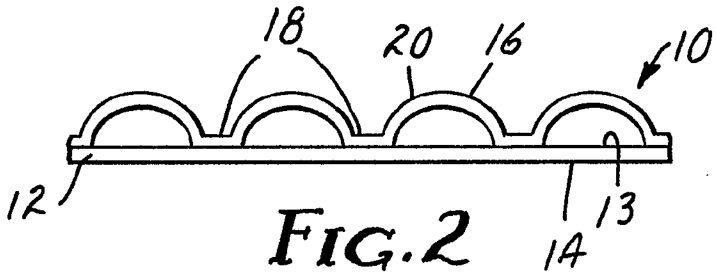

FIG.2

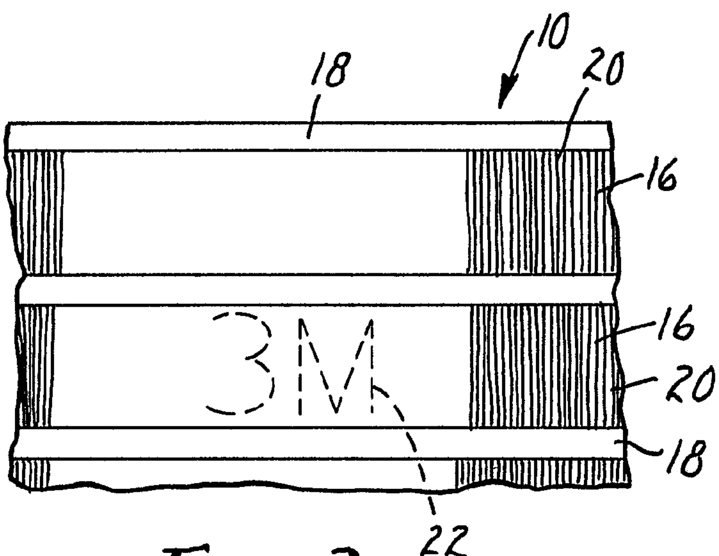

FIG.3

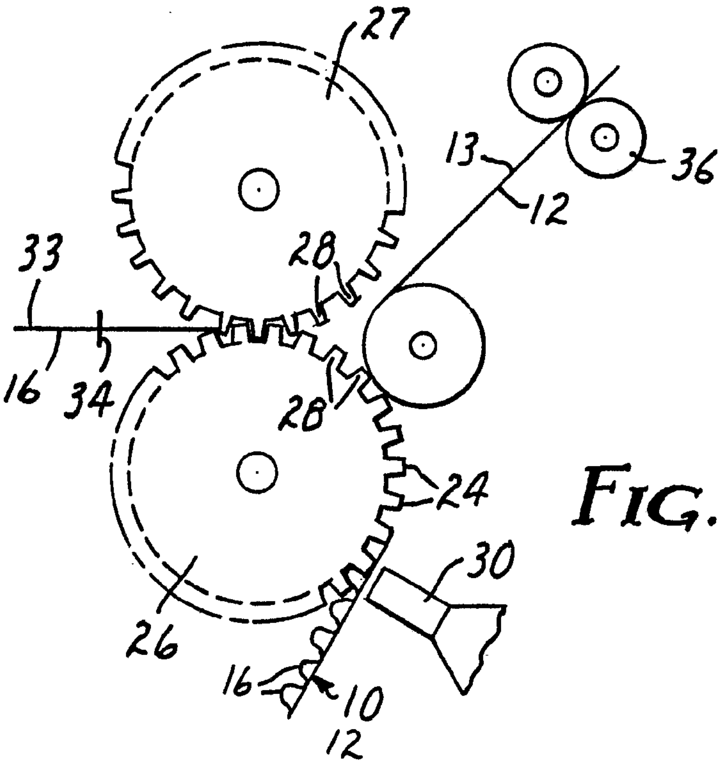

FIG. 4

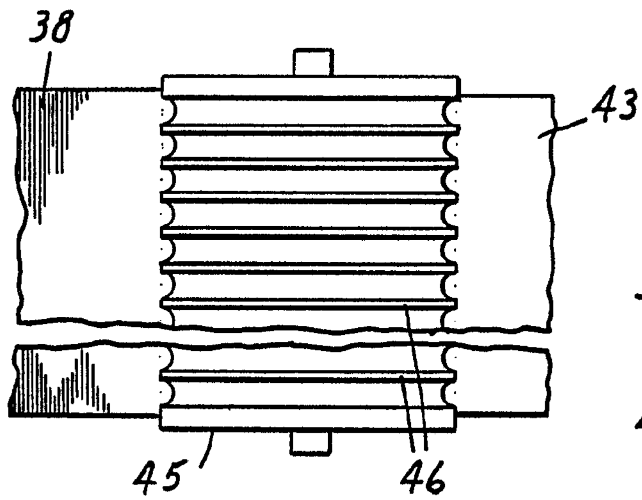

FIG. 5

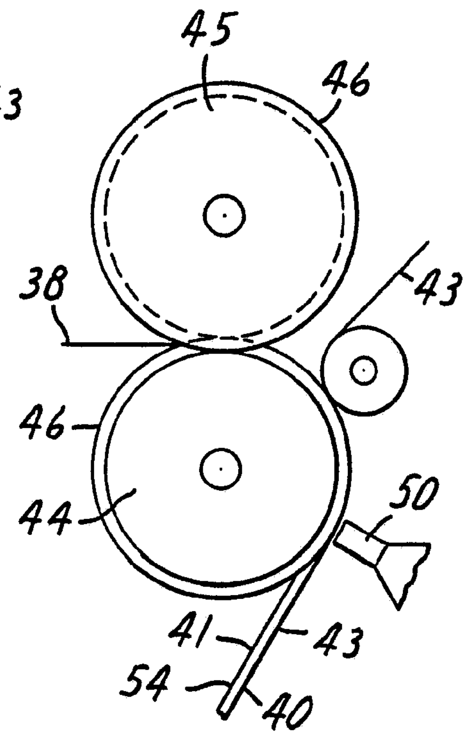

FIG. 6

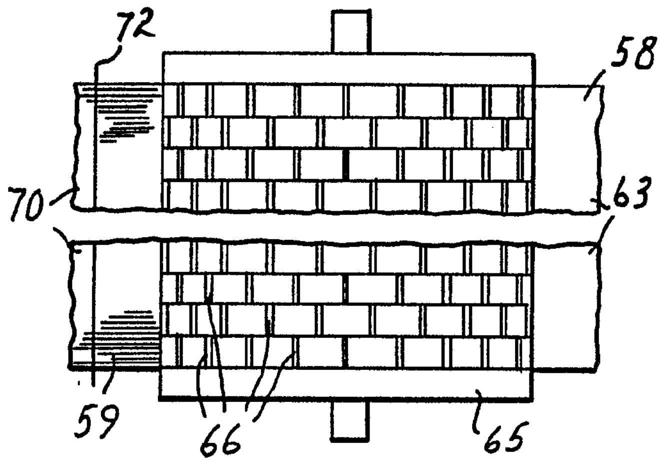

FIG. 7

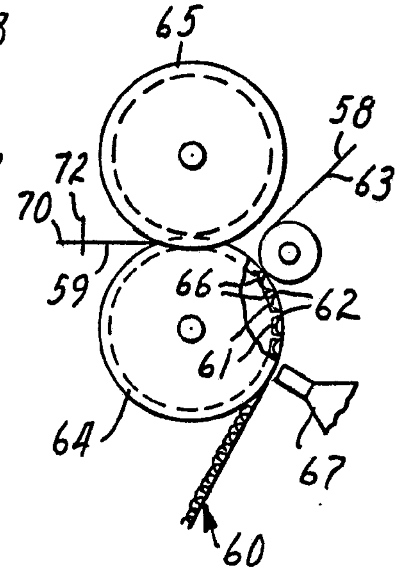

FIG. 8

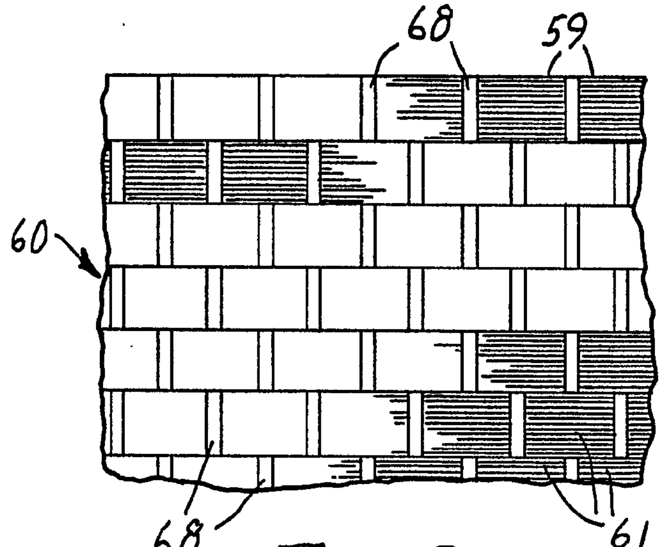

FIG. 9

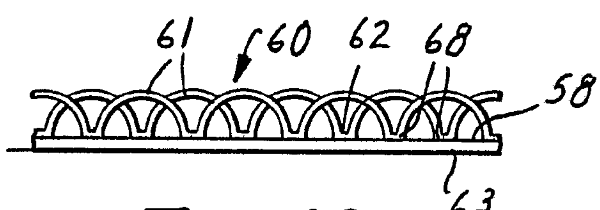

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 4709

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X,P	EP-A-0289198 (THE PROCTER & GAMBLE COMPANY) * column 2, line 25 - column 3, line 19 *	1, 3-7	A44B18/00 D04H11/04
A	* column 5, line 35 - column 13, line 24 *	2, 8, 9, 12, 21, 22	
Y,P	* column 14, line 9 - column 15, line 41; claims 1-6, 12; figures 1-10 *	13-16	
Y	US-A-3869764 (H. UMEZU) * column 2, line 23 - column 4, line 10 *	13-16	
A	* column 5, lines 12 - 54; figures 7, 8, 13-22 *	20, 21	
Y	US-A-3533871 (D. T. ZENTMYER) * column 1, line 64 - column 2, line 68; figures 1-3 *	13-16	
A	GB-A-2168653 (YOSHIDA KOGYO KK) * claims 1, 2; figure 1 *	10	
A	GB-A-2056332 (S.I.A.C.O. LTD) * page 2, lines 69 - 108; claims 1-4; figures 1-7 *	25	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

A44B
D04H
B24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04 AUGUST 1989	GARNIER F.M.A.C.

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